

**CIRCUMSTANTIAL AND RESPONSE ATTITUDES OF PEOPLE AFFECTED
WITH LIVESTOCK DEPREDATION BY LEOPARDS *PANTHERA PARDUS* LINNAEUS
IN RATNAGIRI DISTRICT, MAHARASHTRA, INDIA**

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Livestock depredation by carnivores has become an important hurdle in conservation of predators at the top of the food chain. To develop feasible recommendations to minimize this conflict, it is important to learn the circumstances of the predation events and attitudes of people. We assessed the circumstances for livestock depredation by leopards in Ratnagiri district of Maharashtra in India. Records of Maharashtra Forest Department list 621 compensation claims during April 2004 to June 2009. Interviews of 284 affected people were conducted to collect information on the time of attack, location and activity of livestock at the time of attack, people's perception on the initiation and escalation of the depredation problem, compensation programme and people's solution to the problem. We found that a laid-back attitude while herding, grazing livestock in forest areas was responsible for most of the attacks. Similarly, the locals did not give enough importance to strengthening their livestock enclosures. People perceived that the problem of depredation had started and escalated in recent decades. Although most of them were not happy with the compensation scheme, owing to the meagre amount they got, several affected people showed a positive attitude towards the presence of leopards in their area. Similarly, a fairly good number of interviewed people had started adopting precautionary measures. We concluded that modifications in grazing practices and strengthening of enclosures were the important solutions to the problem of depredation and have suggested several possible approaches for people and the Forest Department.

Key words: leopard, livestock, depredation, grazing, enclosure, conservation, predators, compensation

INTRODUCTION

In the Indian subcontinent, Leopards *Panthera pardus* Linn. 1758 usually, in comparison with other predators, attack more livestock (Rahalkar 2008; Sangay and Vernes 2008). Notwithstanding leopards can also live in human-dominated landscapes with low levels of conflict (Athreya and Belsare 2006). But in the Ratnagiri district of Maharashtra, leopard-attacks on livestock had intensified in 2008 and 2009 (Donikar 2010). However, no cases of purposeful retaliation by livestock owners could be found in the records of the forest department. This could be due to the combined effect of elusiveness and feeding behaviour of leopards that does not allow tracing. This could also be the result of an effective compensation scheme run by the Maharashtra forest department. On the contrary, nearly half of the cases of leopard deaths in the district resulted because of leopards getting snared in wire-nooses placed by farmers for other animals like Wild Pig *Sus scrofa* (Unreported data from Maharashtra forest department).

One of the important aspects in conservation of wild

carnivores in human-dominated landscapes is the attitude of the affected people (Rahalkar 2008; Thavarajah 2008). People's approach towards animal husbandry, as well as response to leopard attacks could play a critical role in designing conflict management strategies. These attitudes could be rooted in their traditions, culture, socio-economics and incentive programmes.

We studied the attitudes of people affected with livestock predation by leopards in Ratnagiri district. We used the compensation database of the Maharashtra forest department at Chiplun subdivision for obtaining names and addresses of claimants. We used questionnaire to collect information from a large number of compensation claimants on circumstances of attacks and their response to the situation.

STUDY AREA

Ratnagiri district (15° 36'-18° 05' N; 73° 05'-74° 36' E) is one of the western coastal districts of Maharashtra (Fig. 1). Its geographical area is nearly 8,200 sq. km. Over 85 per cent of land area of the district is hilly, which includes

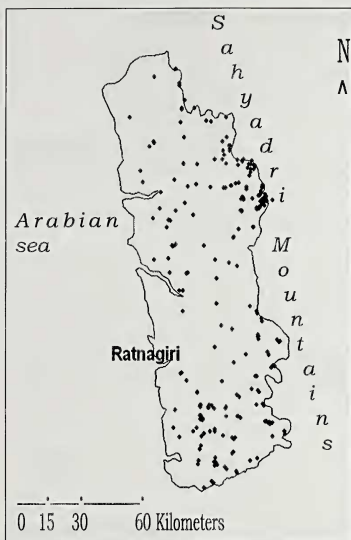


Fig. 1: Locations of leopard attack sites as per information collected from respondents

the Sahyadris (Northern Western Ghats) on its eastern border. Coastal lowlands starkly contrast with the precipitous peaks of the Sahyadris reaching 1,000 m above msl. The climate is tropical with average annual rainfall ranging from 2,500-3,500 mm. The humidity through the year is more than 50 per cent. The summers are hot and winters warm.

This district comprises of a forest Subdivision and three forest ranges. The forest cover is over 51 per cent of the geographical area (FSI 2009). However, most of the forest is under private ownership. Natural vegetation includes moist deciduous and dry deciduous forests, mangrove forest, and grassy plateaus. The landscape is also dominated by rice cultivation and orchards of various horticultural crops, including coconut, areca nut, mango and cashew.

Adjacent to the eastern border of the district are Koyna Wildlife Sanctuary and Chandoli National Park, together proposed as Sahyadri Tiger Reserve. Faunistically, leopard is the largest carnivore here. Several herbivores, like Wild Boar *Sus scrofa*, Spotted Deer *Axis axis*, Nilgai *Boselaphus*

tragocamelus, and Gray Langur *Semnopithecus entellus* are reported in the forest department's census. Similarly, Chousingha *Tetracerus quadricornis* has been found to be widely distributed in this district (Patil and Bhawe 2009).

Human population of Ratnagiri district as per 2001 census was 15.46 lakhs. Only around 9 per cent of the population was urban; the rest being rural. Much of the rural population practices sustenance livestock husbandry. The total livestock population as per the 17th livestock census conducted in 2003 in terms of productive livestock, i.e., goat, buffalo and cattle was 37,562, 60,220, and 4,77,421 respectively (Department of Animal Husbandry, Government of Maharashtra, unpublished data from website www.ah.adfmaharashtra.in).

METHODS

The information on instances of human-leopard conflict in the district for the period from April 2004 to June 2009 was collected from the forest department records. A questionnaire was prepared to collect additional evidence on leopard attacks from the claimants of compensation. The questionnaire was administered to 284 respondents during July 2009 to May 2010. The information collected included time of attack, location of attack, and activity of the livestock when the attack took place. The respondents were asked the exact time of attack if they or anyone else witnessed it, if not, they were asked to report the tentative time of attack considering relevant aspects of the event. For analysis, time data was segregated into 8 time periods of 3-hr slots to effectively cover a day. They were asked if the attacked livestock was grazing, tied in the open or inside an enclosure at the time of attack. Also information was sought on whether the livestock was attacked in a forest area, farmland, inside a village or at its outskirts.

The respondents were asked to report their views on initiation and escalation of the livestock depredation problem. They were given choices – 2 years back, 5 years back, 10 years back and more than 10 years. They were also asked if leopards were always around in their area. Since these people were claimants of compensation from the forest department for loss of livestock, they were asked if they had received the compensation, and if so, were they satisfied with the amount. They were also asked to report preventive measures taken to avoid depredation of their livestock by leopards. This was an open-ended question bringing in a variety of answers. The responses were categorized into three classes – grazing related, enclosure related and general.

The data was viewed from a descriptive perspective and results presented in terms of proportions and percentages.

Wherever possible, observed frequencies were compared with expected frequencies using chi-square test.

RESULTS AND DISCUSSION

Most of the respondents were farmers (93%, n = 263); others being housewives, people employed in sundry government jobs, etc. Farmers practicing sustenance livestock husbandry were found to be the most commonly affected people.

Circumstances of leopard attacks

More than 60 per cent attacks (n = 174) took place during daytime as against 18 per cent (n = 50) during night. 22 per cent (n = 61) attacks took place during dusk and dawn hours (Note the distribution of the attacks in different time slots in Figs 3 and 4). The results contradict the well-known 'nocturnal hunter' image of the leopard. Jenny and Zuberbuhler (2005) have also reported differential behaviours in savannah leopards and forest leopards. They reported that forest leopards were diurnal and crepuscular hunters, as against nocturnal savannah leopards. Findings in our study match their conclusion as the leopards in the study area exhibited a diurnal and crepuscular tendency of attack in more than 80 per cent cases.

Respondents were asked to report the activity of livestock and location of attack when an attack took place (Fig. 2). Two hundred and thirty-two attacks (81%) took place while the livestock were grazing. The remaining 53 (19%) attacks took place when the animals were either inside an enclosure or tied in the open. Maximum attacks (71%, n = 203) took place in the forest area, followed by 58 (20%) on the outskirts of villages. Data indicates that a significant number of attacks took place while the livestock were grazing in forest area, followed by livestock penned inside enclosures at the outskirts of villages ($\chi^2 = 149.76$, df = 6, $p < 0.001$).

Selection of forest as a favourite killing ground is ecologically rooted in the hunting behaviour of a leopard, which is a forest animal. The leopard's hunting success lies in its ability to maintain stealth and stalk its prey. Arivazhagan *et al.* (2007) report that hunting activity of leopards is largely restricted to less disturbed

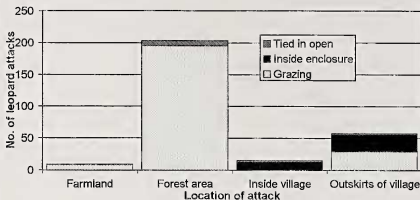


Fig. 2: Distribution of livestock activity with respect to location of leopard attack

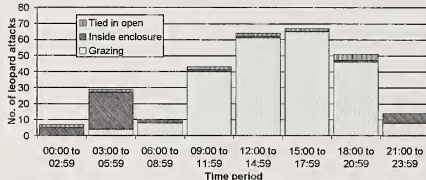


Fig. 3: Distribution of livestock activity with respect to leopard attacks in different time periods of the day

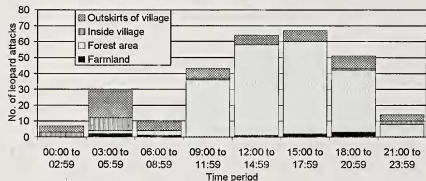


Fig. 4: Distribution of location of leopard attack with respect to different time periods of the day

forest areas, which was corroborated by our study. Similarly, Balme *et al.* (2007) reported that leopards hunted significantly less than expected in grassland habitat. Also, they expected that as long as the density of habitat was not hindering catchability of prey, leopards killed their prey in proportion to its availability.

Another 25 per cent of the attacks took place either at the outskirts or inside a village. At the outskirts of a village, the attacks were irrespective of whether the livestock were grazing or inside an enclosure. Although only five per cent of the attacks were recorded from inside villages, these were invariably of animals inside enclosures.

Patterns in time of attack were more meaningful when considered in combination with activity of livestock (Fig. 3) and location of leopard

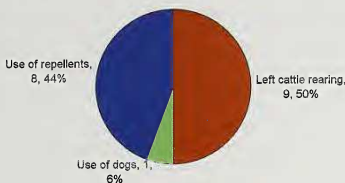


Fig. 5: General steps taken by proactive respondents to prevent livestock depredation by leopard

attack (Fig. 4). Maximum daytime attacks (94%, $n = 219$) took place when the livestock was grazing. Maximum night time attacks (68%, $n = 34$) took place when the livestock were inside enclosures. There was a high significance associated with these observations ($\chi^2 = 175.01$, $df = 14$, $p < 0.001$). Similarly, maximum attacks (82%, $n = 192$) during daytime took place in forest area. Maximum attacks during night time (76%, $n = 38$) took place inside villages or at the outskirts of villages. Here also high significance was associated with these observations ($\chi^2 = 131.01$, $df = 21$, $p < 0.001$).

The results indicate that daytime grazing of livestock in forest area made it vulnerable to leopard attacks. The practice of open grazing in forest area is perhaps crucial for escalating livestock depredation in this region. Wang and McDonald (2006) also reported lax herding, inadequate guarding, and overgrazing as factors for aggravating livestock depredation. In the study area too livestock were left to graze without any serious guarding. Usually children or elderly people took the responsibility of guarding the grazing livestock. These attitudes might have further enhanced the rate of depredation. The study also revealed that at least 12 livestock were killed in the darkest hours of the night while grazing. This was astonishing and exposed the habit of carelessly leaving livestock grazing on their own. Stall-feeding in our study region was observed to be a not-so-favoured practice among the farmers. Therefore, increased levels of guarding and careful herding seem to be the only solution to the problem of depredation during grazing. Guarding of livestock in this region varies in terms of number of guards, age of the guards, and number of guards to livestock. Although we did not explore these issues, further studies would help to outline patterns in these aspects so that appropriate solutions could be recommended. Avoiding forest areas could also be of help.

Most of the attacks inside an enclosure took place during night time. Hence, strengthening of livestock enclosures could

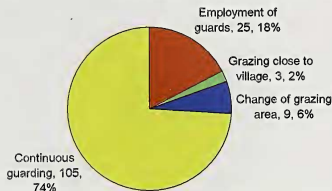


Fig. 6: Steps taken by proactive respondents to prevent leopards from preying on their livestock during grazing

be one of the important steps in curtailing leopard attacks on livestock. Ogada *et al.* (2003) presented a very good case of bomas, i.e., cattle enclosures in Kenya. They found that solid bomas performed best over other types made from brushwood, wicker and wire. They also found that the height of the enclosure did not matter much for a leopard. Thus, an enclosure with strong walls and solid roof could effectively reduce predation by leopard.

Peoples' solution

Most individuals had suffered predation of livestock by leopards only once. But 24 individuals had their livestock attacked twice, four individuals thrice and one person on five occasions. Thus, nearly 5 per cent ($n = 29$) of the affected individuals had suffered repeated attacks on their livestock. Although, 95 per cent people had been affected only once, increase in predation or awareness might have prompted them to take steps to protect their livestock. The respondents were also asked to report these steps.

Nearly 65 per cent ($n = 184$) respondents reported the steps taken to prevent leopard attacks on their livestock; these respondents were called proactive respondents. The response was grouped into three categories – general response, grazing related response and enclosure related response.

Seventy-seven per cent ($n = 142$) of the proactive respondents changed their grazing practice, 17 per cent ($n = 31$) enclosure characteristics, and 10 per cent ($n = 18$) general aspects of livestock rearing. The sum total does not yield 100 per cent as some proactive respondents took more than one step to secure their livestock.

Among the general steps, 50 per cent respondents abandoned cattle rearing (Fig. 5). 44 per cent created din, i.e., burst crackers, etc. when a leopard approached. Only one respondent began using a dog to guard the livestock. Continuous guarding and employment of guards were the major shifts in grazing practice followed by 92 per cent ($n = 130$) of the respondents (Fig. 6). Changing grazing area

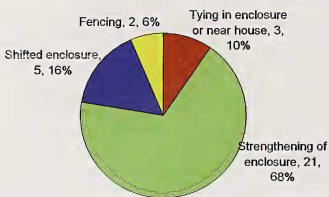


Fig. 7: Steps taken by proactive respondents to prevent leopards from preying on their livestock inside enclosures

and grazing close to villages was followed by a few proactive respondents. Enclosures were strengthened (68 per cent proactive respondents, $n = 21$) and shifted to a secure place (16 per cent proactive respondents, $n = 5$) (Fig. 7). Other steps included improvement of fencing and precautions to tie livestock either inside an enclosure or near the house.

A good number of individuals were observed taking precautions to prevent depredation of their livestock. Guarding livestock while grazing was one of the major steps in this direction.

Perceptions about human-leopard conflict

Perceptions of respondents to the status of human-leopard conflict in their surroundings was assessed by posing questions about presence of leopards, time-scale and intensity of depredation problem and their willingness to have leopards around. A large percentage (95%, $n = 270$) of respondents informed that leopards were always around. It was interesting to learn that of the remaining 14 respondents, 13 belonged to Dapoli range, this highlights the expansion of human-leopard conflict in Dapoli range in recent times.

Similarly, 79 per cent ($n = 225$) respondents said that the problem of leopard depredation on livestock had started long ago. Relatively fewer respondents informed that the problem started five years ago (8%, $n = 22$) and 10 years ago (13%, $n = 37$). Nearly 44 per cent ($n = 26$) of the respondents who felt that the problem did not start long ago were from Dapoli.

Although a high percentage of respondents felt that the problem had started long ago, only 25 per cent ($n = 72$) felt that the problem had escalated long ago. A relatively higher percentage (39%, $n = 112$) felt that the problem had escalated five years ago and 31 per cent ($n = 89$) felt that the problem had escalated 10 years ago. Only a marginal number of respondents, i.e., 11 felt that the problem had escalated two years ago.

When respondents were asked whether they wanted leopards around either with or without its depredation problem, the response was mixed. It was not surprising that nearly 56 per cent ($n = 158$) respondents were hostile towards presence of leopards. Close to 44 per cent respondents were, however, positive in their outlook and wanted leopards around, but without the depredation problem. Only two respondents wanted leopards around with the depredation problem. It was a positive sign that a fairly large number of individuals were receptive to the presence of leopards, especially since they had suffered loss of livestock.

Perceptions on Compensation

Even among the respondents, the percentage of claimants that received compensation was high (82%, $n = 233$). However, the satisfaction level with this compensation was very low. Only about 43 per cent ($n = 101$) of the claimants who received compensation were happy with it and said that it was adequate. The remaining (57%, $n = 132$) found it inadequate.

The compensation figures indicate that majority of the claimants had received compensation for loss of livestock. Albeit, the amount received may not be worth the trouble a claimant undertook during the procedure, which may take more than 6 months until actual receipt of money. Although compensation is not a solution to human-wildlife conflict, it is expected to prepare people to accept the presence of predators and certain levels of livestock depredation, which we have already discussed. It was, therefore, not surprising that the Maharashtra forest department had come-up with a fresh compensation scheme in 2010, with considerably enhanced rates of compensation.

CONCLUSIONS

Exploration of circumstantial evidence revealed that lax grazing in forest areas was the common situation at the time of leopard attack on livestock. It could be concluded that people needed to change their attitudes to protect their livestock themselves. People had already started improving the guarding regime while grazing their livestock. Sustaining this approach appears necessary to prevent livestock depredation. Although compensation provides temporary relief, it can never match financial benefits had the livestock been alive.

Compensation programme of the forest department was found to be effective in Ratnagiri district, providing benefit to a large proportion of claimants. However, our observations also revealed (unrecorded) that a number of cases of livestock

depredation go unreported. A proactive approach on part of the forest department could build faith in people. The forest department could also take up a programme to subsidize strengthening of livestock enclosures. Similarly, it could concentrate on preventive measures in Dapoli range where the problem has just begun, and undertake a curative approach in ranges where the problem of depredation was an established one. The forest department also needs to maintain information on circumstantial facts for further analysis of trends.

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